CLAIMS

1. In a process for the polymerization of olefins, a method for controlling the melting point of a polyolefin, said method comprising:

(a) controlling the number of inversions in the chain of the xylene insoluble fraction of the polyolefin during the polymerization of olefin monomer;

(b) contacting an organoaluminum compound with a metallocene catalyst described by the formula:

$$R''(C_5R'_m)_2\ Me\ Q_p$$

wherein $(C_5R'_m)$ is a cyclopentadienyl or substituted cyclopentadienyl; R' is hydrogen or hydrocarbyl radical having from 1 to 20 carbon atoms, each R' may be the same or different; R" is an alkylene radical having 1-4 carbon atoms, a silicon hydrocarbyl compound, a germanium hydrocarbyl compound, an alkyl phosphine, or an alkyl amine, and R" acts to bridge the two $(C_5R'_m)$ rings; Q is a hydrocarbon radical such as an aryl, alkyl, alkenyl, alkylaryl or arylalkyl radical having 1-20 carbon atoms or is a halogen; Me is a group 4b, 5b or 6b metal as designated in the Periodic Table of Elements; $0 \leq m \leq 4$; and $0 \leq p \leq 3$; and

(c) contacting an olefin monomer with said catalyst and said aluminum compound either simultaneously with or after step (b).

2. A polyolefin produced by the process comprising:

(a) controlling the number of inversions in the chain of the xylene insoluble fraction of the polyolefin during the polymerization of olefin monomer;

(b) contacting an organoaluminum compound with a metallocene catalyst described by the formula:

$$R''(C_5R'_m)_2 \ Me \ Q_p$$

wherein $(C_5R'_m)$ is a cyclopentadienyl or substituted cyclopentadienyl; R' is hydrogen or hydrocarbyl radical having from 1 to 20 carbon atoms, each R' may be the same or different; R" is an alkylene radical having 1-4 carbon atoms, a silicon hydrocarbyl compound, a germanium hydrocarbyl compound, an alkyl phosphine, or an alkyl amine, and R" acts to bridge the two $(C_5R'_m)$ rings; Q is a hydrocarbon radical such as an aryl, alkyl, alkenyl, alkylaryl or arylalkyl radical having 1-20 carbon atoms or is a halogen; Me is a group 4b, 5b or 6b metal as designated in the Periodic Table of Elements; $0 \leq m \leq 4$; and $0 \leq p \leq 3$; and

(c) contacting an olefin monomer with said catalyst and said aluminum compound either simultaneously with or after step (b).

3. A process for the polymerization of olefins comprising:

(a) contacting an organoaluminum compound with a metallocene catalyst described by the formula:

$$R''(C_5R'_m)_2\ Me\ Q_p$$

wherein $(C_5R'_m)$ is a cyclopentadienyl or substituted cyclopentadienyl; R' is hydrogen or hydrocarbyl radical having from 1 to 20 carbon atoms, each R' may be the same or different; R" is an alkylene radical having 1-4 carbon atoms, a silicon hydrocarbyl compound, a germanium hydrocarbyl compound, an alkyl phosphine, or an alkyl amine, and R" acts to bridge the two $(C_5R'_m)$ rings; Q is a hydrocarbon radical such as an aryl, alkyl, alkenyl, alkylaryl or arylalkyl radical having 1-20 carbon atoms or is a halogen; Me is a group 4b, 5b or 6b metal as designated in the Periodic Table of Elements; $0 \leq m \leq 4$; and $0 \leq p \leq 3$;

(b) contacting an olefin monomer with the metallocene catalyst and the organoaluminum compound either simultaneously with or after (a); and

(c) withdrawing a polymer product,

wherein the process provides control of the melting point of the polymer product by controlling the number of inversions in the xylene insoluble fraction of the polymer during polymerization, and the melting point of the polymers may be varied by varying the R' or R" groups on the metallocene catalyst.

4. The process of Claim 3 wherein the metallocene catalyst is a zirconocene.

5. The process of Claim 3 wherein the metallocene catalyst is a titanocene.

6. The process of Claim 3 wherein the R" bridge of the metallocene catalyst is an alkyl silicon compound.

7. The process of Claim 3 wherein the organoaluminum compound is an alumoxane.

8. The process of Claim 3 wherein the olefin monomer is propylene.

9. The process of Claim 3 wherein the number of inversions in the xylene insoluble fraction are controlled by the R" group in the metallocene catalyst.

10. The process of Claim 3 wherein the number of inversions in the xylene insoluble fraction are controlled by the R' groups attached to the cyclopentadienyl rings.

11. A method for controlling the melting point of an olefinic polymer produced in the presence of a chiral, stereorigid metallocene catalyst having an interannular bridge, comprising varying the structure of said bridge.

12. The method of Claim 11 wherein the metallocene catalyst is described by the formula:

$$R''(C_5R'_m)_2\ Me\ Q_p$$

wherein $(C_5R'_m)$ is a cyclopentadienyl or substituted cyclopentadienyl; R' is hydrogen or hydrocarbyl radical having from 1 to 20 carbon atoms, each R' may be the same or different; R" is an alkylene radical having 1-4 carbon atoms, a silicon hydrocarbyl compound, a germanium hydrocarbyl compound, an alkyl phosphine, or an alkyl amine, and R" is a bridge between the two $(C_5R'_m)$ rings; Q is a hydrocarbon radical such as an aryl, alkyl, alkenyl, alkylaryl or arylalkyl radical having 1-20 carbon atoms or is a halogen; Me is a group 4b, 5b or 6b metal designated in the Periodic Table of Elements; $0 \leq m \leq 4$; and $0 \leq p \leq 3$.

13. The method of Claim 12 wherein the R" bridge is varied to include a silicon atom in the bridge.

14. The method of Claim 12 wherein the R" bridge is varied to include an alkyl silicone compound.

15. The method of Claim 12 wherein the R" bridge is changed to include an alkylene compound.

16. The method of Claim 12 wherein the metallocene catalyst is selected from the group consisting of titanocene, zirconocene, and hafnocene.

17. The method of Claim 12 wherein the olefin monomer is propylene.

18. The method of Claim 12 further comprising changing the R' group attached to the cyclopentadienyl rings in the metallocene catalyst.

19. A method for controlling the molecular weight of an olefinic polymer produced in the presence of a chiral, stereorigid metallocene catalyst having interannular bridges comprising varying the structure of said bridge.

20. The method of Claim 19 wherein said metallocene catalyst is described by:

$$R''(C_5R'_m)_2 \ Me \ Q_p$$

wherein $(C_5R'_m)$ is a cyclopentadienyl or substituted cyclopentadienyl; R' is hydrogen or hydrocarbyl radical having from 1 to 20 carbon atoms, each R' may be the same or different; R" is an alkylene radical having 1-4 carbon atoms, a silicon hydrocarbyl compound, a germanium hydrocarbyl compound, an alkyl phosphine, or an alkyl amine, and R" is a bridge between the two $(C_5R'_m)$ rings; Q is a hydrocarbon radical such as an aryl, alkyl, alkenyl, alkylaryl or arylalkyl radical having 1-20 carbon atoms or is a halogen; Me is a group 4b, 5b or 6b metal designated in the Periodic Table of Elements; $0 \leq m \leq 4$; and $0 \leq p \leq 3$.

21. The method of Claim 19 wherein the metallocene catalyst is selected from the group consisting of titanocene, zirconocene, and hafnocene.

22. The method of Claim 19 wherein the bridge is changed to include a silicon atom in the bridge.

23. The method of Claim 19 wherein the bridge is changed to include an alkyl silicon compound.

24. The method of Claim 20 wherein the $(C_5R'_m)$ is an indene.

25. The method of Claim 20 wherein the R" bridge is changed to include an alkylene compound.

26. The method of Claim 20 further comprising changing the R' group.

27. A method for varying the melting point of a polyolefin in the polymerization of an olefin monomer, said method comprising:

(a) utilizing an organoaluminum compound, a metallocene catalyst and an olefin monomer in a polymerization reaction, said metallocene catalyst being stereorigid, chiral and described by the formula:

$$R''(C_5R'_m)_2 \ Me \ Q_p$$

wherein $(C_5R'_m)$ is a cyclopentadienyl or substituted cyclopentadienyl; R' is hydrogen or hydrocarbyl radical having from 1 to 20 carbon atoms, each R' may be the same or different; R" is an alkylene radical having 1-4 carbon atoms, a silicon hydrocarbyl compound, a germanium hydrocarbyl compound, an alkyl phosphine, or an alkyl amine, and R" is a bridge between the two $(C_5R'_m)$ rings; Q is a hydrocarbon radical such as an aryl, alkyl, alkenyl, alkylaryl or arylalkyl radical having 1-20 carbon atoms or is a halogen; Me is a group 4b, 5b or 6b metal designated in the Periodic Table of Elements;
$0 \leq m \leq 4$; and $0 \leq p \leq 3$; and

(b) changing the R' group on the cyclopentadienyl rings.

28. The method of Claim 27 wherein R' is changed to include hydrogen.

29. The method of Claim 27 wherein the metallocene catalyst is zirconocene.

30. The method of Claim 27 wherein the olefin monomer is propylene.

31. The method of Claim 27 wherein the metallocene catalyst is hafnocene.

32. A method for varying the molecular weights of a polyolefin in the polymerization of an olefin monomer, said method comprising:

(a) utilizing a metallocene catalyst, an organoaluminum compound and an olefin monomer, said catalyst being of the formula:

$$R''(C_5R'_m)_2 \ Me \ Q_p$$

wherein $(C_5R'_m)$ is a cyclopentadienyl or substituted cyclopentadienyl; R' is hydrogen or hydrocarbyl radical having from 1 to 20 carbon atoms, each R' may be the same or different; R" is an alkylene radical having 1-4 carbon atoms, a silicon hydrocarbyl compound, a germanium hydrocarbyl compound, an alkyl phosphine, or an alkyl amine, and R" is a bridge between the two $(C_5R'_m)$ rings; Q is a hydrocarbon radical such as an aryl, alkyl, alkenyl, alkylaryl or arylalkyl radical having 1-20 carbon atoms or is a halogen; Me is a group 4b, 5b or 6b metal designated in the Periodic Table of Elements;
$0 \leq m \leq 4$; and $0 \leq p \leq 3$; and

(b) changing the R' group on the cyclopentadienyl rings.

33. The method of Claim 32 wherein the R' is changed to include hydrogen.

34. The method of Claim 32 wherein the metallocene catalyst is selected from the group consisting of titanocene, zirconocene, and hafnocene.

35. The method of Claim 32 wherein the olefin monomer is propylene.

36. The method of Claim 32 wherein the metallocene catalyst is a hafnocene.